Comparison of selenium biofortified green pea in calcareous chernozem and sandy soils

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Currently, it is estimated that the deficit of micronutrients in food affects several hundred million people worldwide. Selenium (Se) is a micronutrient that is usually ingested in lower amounts than the daily dose prescribed by the Food and Agriculture Organization. Insufficient intake of Se increases the risk of several diseases. Se enters the food chain through plants, and the Se concentration of plants varies according to available soil Se concentration, its bioavailability for uptake into plant roots (which depends heavily on redox equilibria in the soil, but also on several other factors) and species of plants. Another important factor to consider is that the window of Se intake from deficiency to toxicity is rather narrow. Green pea is a valued protein source for the nutritional quality of its seeds for animal feeds and human consumption, while its pods and shoots can be used as forage, too.

The greenhouse pot experiment was performed with calcareous chernozem and sandy soils. Se (as two forms of sodium selenite (Na_2SeO_3; active form: Se^{IV}) and sodium selenate (Na_2SeO_4; active form: Se^{VI}) in two concentrations 0 (control) and 30 mg kg^{-1}) was manually sprayed and supplemented to the soil as an aqueous solution. Green Peas (*Pisum sativum* L.) were sown in separate experiments with three replications and the bi-factorial trials were arranged in a randomized complete block design. At the third stage of growing (the third true leaf has unfolded at the third node), immature plants were removed so that eight intact and mature plants remained in every pot. Growing period lasted 50 days in May and June and plants were harvested at maturity. Morphological traits, relative chlorophyll content (SPAD level), chlorophyll fluorescence parameters, malondialdehyde content, peroxidase (POX) activity, total soluble protein content, and quantification of total Se of green pea were measured. Meanwhile, biotransformation of inorganic Se was evaluated using HPLC-ICP-MS for Se-species separation in the above ground parts of green pea grown in both soils.

Due to high doses Se toxicity, especially in Se^{VI} treatments, 30 mg kg^{-1} Se^{VI} samples didn't grow. Whereas compared to the control, 30 mg kg^{-1} Se^{IV} decreased the growth biomarkers. Also, SPAD level, chlorophyll fluorescence parameters, POX activity of leaves and total protein content showed significant decrease in both soils but this decrease in sandy soil's samples was more. Meanwhile, membrane lipid peroxidation increased but in sandy soils increased more. The total Se content in all of the green pea plant's organs increased with increasing Se^{IV} in both soils, whereas Se uptake in sandy soil's samples were less. The main selenocompound in all samples was selenomethionine. Increasing the Se supplementation lead to higher selenomethionine concentration. Although, these amounts were less in samples grown in sandy soil.